Vibrational enhancement of nuclear level density within response function method

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The response function approach was proposed in Ref.[1] for calculation of vibrational enhancement of nuclear level density[2]. It allows to take into account the damping of vibrational states in a rather accurate way. Vibrational states are considered as collective states formed both by coherent interactions of a separable form and by non-coherent residual interaction for description of the damping.

In this contribution this method is modified and corrected. The variation of the partition function ΔZ due to collective vibration is calculated as the Matsubara sums[3] for collective response function. The nuclear response function is determined by the use of the Landau-Vlasov kinetic equation. Non-coherent residual interactions are included within relaxation time method with retardation effects during two-body collisions[4]. Ratio, K, of nuclear level densities with and without allowing for vibrational states is studied as a function of the excitation energy. The effect of the collective state damping both on factor K and on nuclear temperature is considered. The results of the calculations demonstrates rather strong dependence of K on a shape of the vibrational state damping width.

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1.V.A. Plujko, O.M.Gorbachenko.In:"Capture gamma-ray spectroscopy and related topics". Proc.11-th Int.Symp. 2-6 Sept.,2002, Pruhonice near Prague, Czech Republic, Eds. J.Kvasil, P.Cejnar, M.Krticka. Word Sc.Pub.Co., New Jersey,London. 2003. PP.789-792.

2.A.V. Ignatyuk. In: Handbook for calculations of nuclear reaction data. (RIPL1). IAEA- TECDOC- 1034, August 1998, Ch.5;http: //www-nds.iaea.or.at/ripl/.

3.A.L. Fetter, J.D.Walecka. Quantum theory of many-particle systems. McGraw-Hill, Inc., NY, 1971.

4.V.A.Plujko et al., J.Phys.:CM, 14(2002)9473.

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